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A NEW NIOBRARA TOXOCHELYS

By G. R. Wieland.

(With Plate X.)

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Art. XXXVI.—*A New Niobrara Toxochelys;** by G. R. Wieland. (With Plate X.)

None of the numerous marine, or semi-marine turtles from the Kansas chalk or Niobrara Cretaceous have proven of greater interest than the forms included within the genus *Toxochelys*. For this wholly extinct American group unites carapacial and plastral characters of the *Lytolomas* of the Upper Cretaceous of New Jersey with *Chelydra*-like cranial features, and is well represented by a considerable number of specific forms and variations presenting fairly clear evidence that we have here to deal with a line which independently acquired the modifications of limb structure suiting at least some of its members to a marine habitat.

Moreover it is very significant that discrete epi-neural ossicles somewhat similar to those the writer supposed might be present in *Archelon* are borne serially either on the neuralia, or over the neural junctions in an order suggesting that they have an ancient history, possibly analogous to the ossicles of somewhat similar form so characteristic of the Crocodilidæ and in part the Chelydridæ. These ossicles as noted further on were first observed in *Toxochelys* (*serrifer*) *stenoporis* by Case (2) and later more fully described and commented on by Hay (6, 7, 8). The character of the entire series is, however, now determined for the first time. The idea that such ossi-

* The writer's previous contributions, mainly on the marine turtles, are as follows :—

This Journal, vol. ii, Dec., 1896, pp. 399–412, pl. VI. American Naturalist (p. 446), 1897. This Journal, vol. v, Jan., 1898, pp. 15–20, pl. II ; vol. ix, Apr., 1900, pp. 237–251, pl. II ; vol. ix, June, 1900, pp. 413–424 ; vol. xiv, Aug., 1902, pp. 95–108 ; vol. xv, March, 1903, pp. 211–216 ; vol. xvii, Feb., 1904, pp. 112–132, pls. I–IX ; vol. xviii, Sept., 1904, pp. 183–196, pls. V–VIII.—(In Press,—Protostega ; Memoirs, Carnegie Museum of Pittsburgh ; Plastron of Protosteginæ.)

cles really represent a disappearing series of dermal elements is further strengthened by the writer's observation that interpolated ossicles also occur in the marginal series of occasional specimens of *Lytoloma angusta*, as will be further considered below.

Despite the frequent occurrence of Toxochelyds in the Niobrara, until now no complete carapace has been described. It is, therefore, of timely interest that a specimen collected by Mr. Charles H. Sternberg in Gove County, Kansas, and very recently acquired by the Yale Museum, includes a carapace and plastron sufficiently complete to determine accurately all the details of shell structure and form. The original locality, according to Mr. Sternberg, is in a ravine about three miles north of Monument Rocks, and about four miles east of the western Gove County line. This fossil is numbered 2823 in the Yale Museum accession list, and on the basis of the analysis given below is referred to the new species *Toxochelys Bauri*, in honor of that distinguished student of the Testudinata the late lamented Professor Georg Baur. As shown on Plate X, *T. Bauri*, represents one of the most ornate of all extinct Testudinate species. The type consists in the following elements:—

The nuchal and eight closely articulated neuralia with the ninth median or post-neural element bipartite, and followed by an antero-pygal and the pygal marginal (the postero-pygal being the only median element absent); three epi-neural ossicles respectively seated on the 3d and 4th, the 5th and 6th, and the 8th–10th members of the neural series; the 1st–3d, and the 8th–11th right marginals; the 4th–6th, 8th and 10th left marginals; most of the pleuralia; also the right hyo- and hypoplastron nearly complete, and various fragments of vertebræ with several centra and arches. Of the right pleuralia the first and seventh are complete, and the third, fourth and sixth only lack rib-tips, while the expanded plates of all the right pleurals but the distal portion of the fifth, are fortunately present. On the left side the pleurals are not so complete, only the proximal ends having been recovered, with the exception of the third, which only lacks a middle portion of the plate. Cf. figure 6.

The hyo- and hypoplastron lack their interior digitations, but fortunately permit an approximate restoration from what is known of the plastron of several other species (cf. figure 7). The fragmentary or not directly determinable skeletal parts include two dorsal centra, 4^{cm} in length, and several caudal centra, with a few portions of cervicals.

With the exception of some of the middle and anterior marginals, which are curiously crushed from very different

angles, the various elements of the present in reality exceptionally fine fossil do not appear to have been much displaced in their original chalk matrix. This had been removed, however, and aside from the neurals, which remained for the greater part solidly articulated, any clues to form and organization afforded by position in the matrix had been thus destroyed before the specimen reached the Yale Museum.

Despite this crushing and dissociation of parts, as the result of a careful joint examination by the Museum preparateur, Mr. Gibb, and the writer, it has nevertheless proven possible for the former to make a very handsome and successful mounting of the fine carapace with the considerably restored plastron in its approximately natural position, as illustrated on Plate X, and figures 1–3, and 6, 7. In fact it is owing to the presence of the nearly complete hyo- and hypoplastron that we are enabled to determine the true width of the carapace, which is indicated in the corrected drawing (figure 1) based in part on the measurement thus obtained. The specimen itself is mounted more nearly as removed from the chalk matrix, the width being somewhat exaggerated by compression. For it was at once decided that it would be far better in mounting the specimen to adhere nearly to the form that had resulted from crushing in the matrix, rather than to distort the junctions of the several elements in an effort to reach the elongate form *Toxochelys Bauri* really had. The restoration is accordingly, although at first sight indicating a considerable length of shell, not nearly so narrow and relatively long as originally in life,—an interesting fact because this is almost the only marine form with a carapace suggestive of the great length seen in *Dermochelys*.

Description of Parts.

As the main features of the anatomy of the carapace appear in sufficient detail in the summary of characters and measurements given below, taken in conjunction with the accompanying figures and plates, we may pass on to a discussion of the special or unique features of interest, namely the *nuchal*, the *epi-neural spines*, and the *pygal region*.

Nuchal.—The Trionychid-like fontanelles at the junction of the nuchal, first neural and pleurals (figure 1, *f*), are circular to slightly elliptical, and 1^{cm} in diameter. Such have not been hitherto observed to occur outside the Trionychids, and with the general form of the nuchal suggest a certain connection with original lines less distant from the Trionychid stocks than are the Cheloninæ. Elsewhere the writer has suggested that the Nuchal and Epiplastra of *Dermochelys*, *Protostega*, and the *Jurassic* Thalassemyds may go to indicate a yet

closer relationship to stocks ancestral to the Trionychidæ, and that there are many most suggestive indications that indepen-

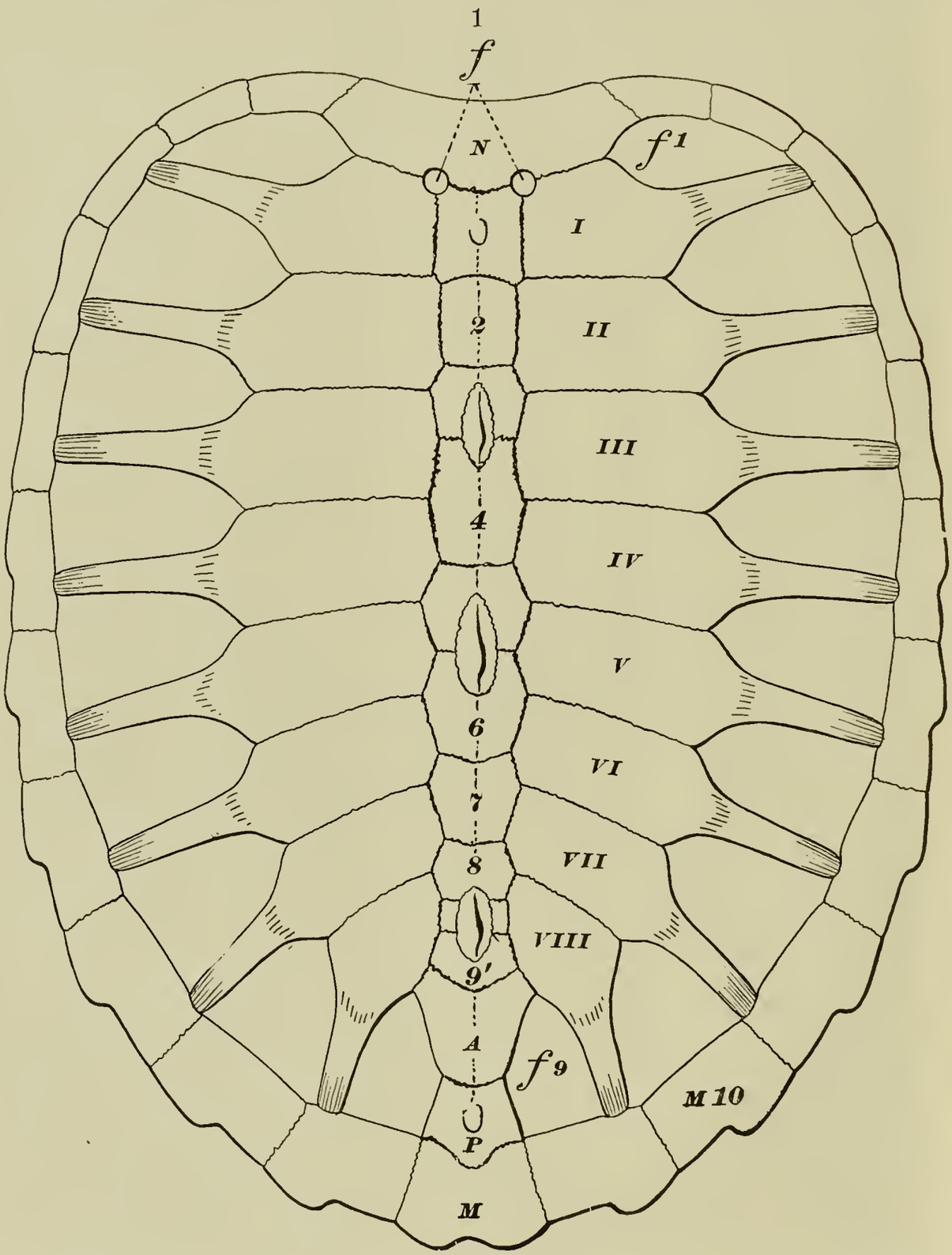

FIGURE 1.—Carapace of *Toxochelys Bauri* Wieland, × ¼ nearly. (Drawn from type.) *N*, Nuchal; 2, 4, 6, 8, Neuralia; 9′, posterior segment of the 9th or post-neural element of the median series; *A*, Antero-pygal; *P*, Postero-pygal; *M*, Marginalo-pygal; I–VIII, the Pleuralia; *M10*, 10th (rib-free) Marginal; *f*, the post-nuchal foramina; f^1, f^8, 1st and 8th pleuro-marginal fontanelles. The three Epi-neurals are not lettered.

dent marine races of Testudinates, of which at least a half dozen may be enumerated, have been repeatedly developed ever since the Jurassic.

It is also of much interest that while in forms like *Osteopygis* a nether nuchal process is wholly absent, there is in the present turtle a mere, although distinct beginning of such a

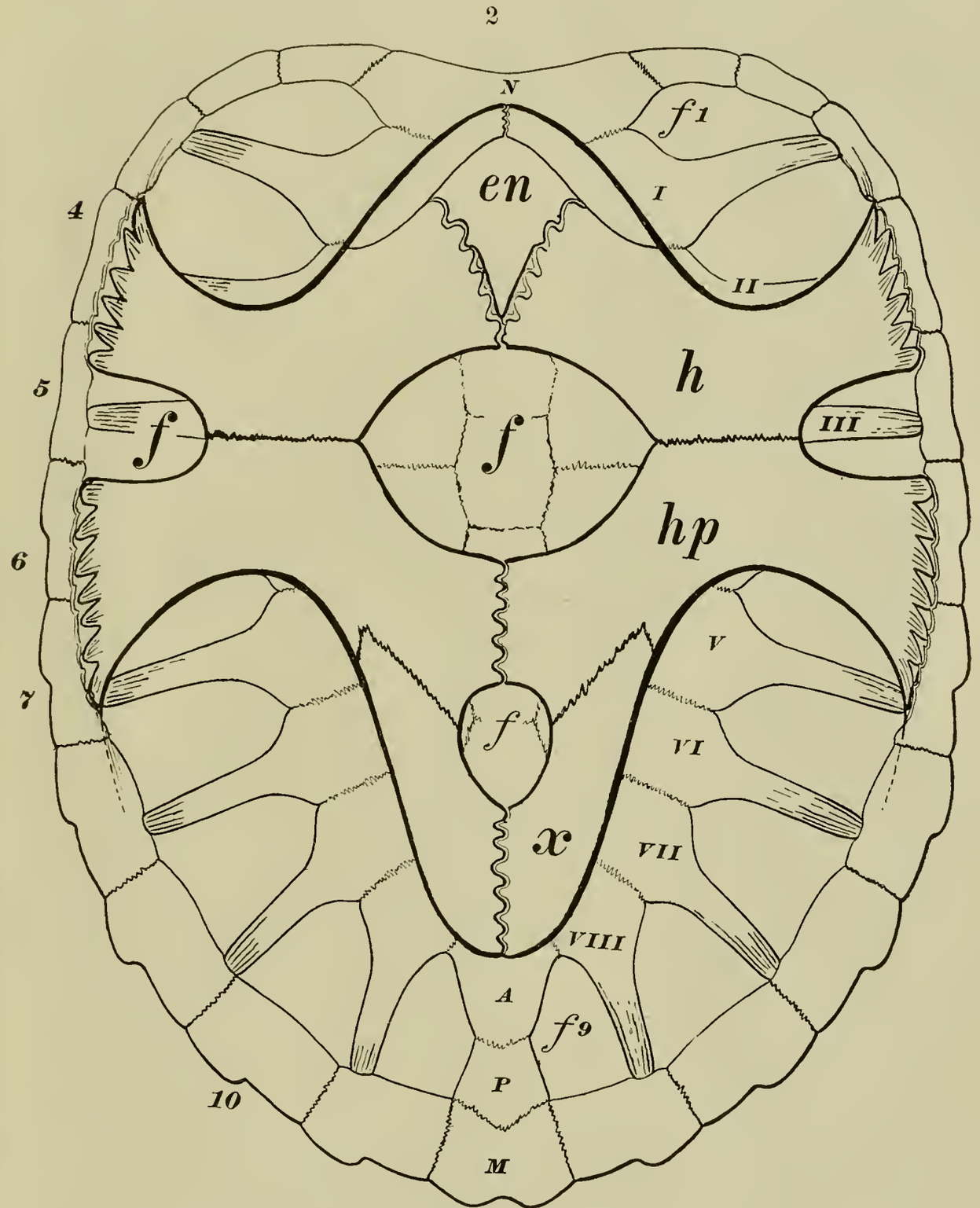

FIGURE 2.—Plastral view of *Toxochelys Bauri* Wieland, ×¼ nearly. (Drawn from type).—*en*, Entoplastron; *h*, Hyoplastron; *hp*, Hypoplastron; *x*, Xiphiplastron; *f*, *f*, *f*, the median and the lateral hyo-hypoplastral, and the hypo-xiphiplastral foramina; 4–7, the plastron-supporting marginalia. Other letters as in figure 1.

process, and in *Toxochelys latiremis* a much larger projection for actual cervical articulation. This process thus appears to have arisen in different groups rather than to have been com-

monly present in Cretaceous turtles, and may now be considered to have been definitely traced to its origin in at least one genus.

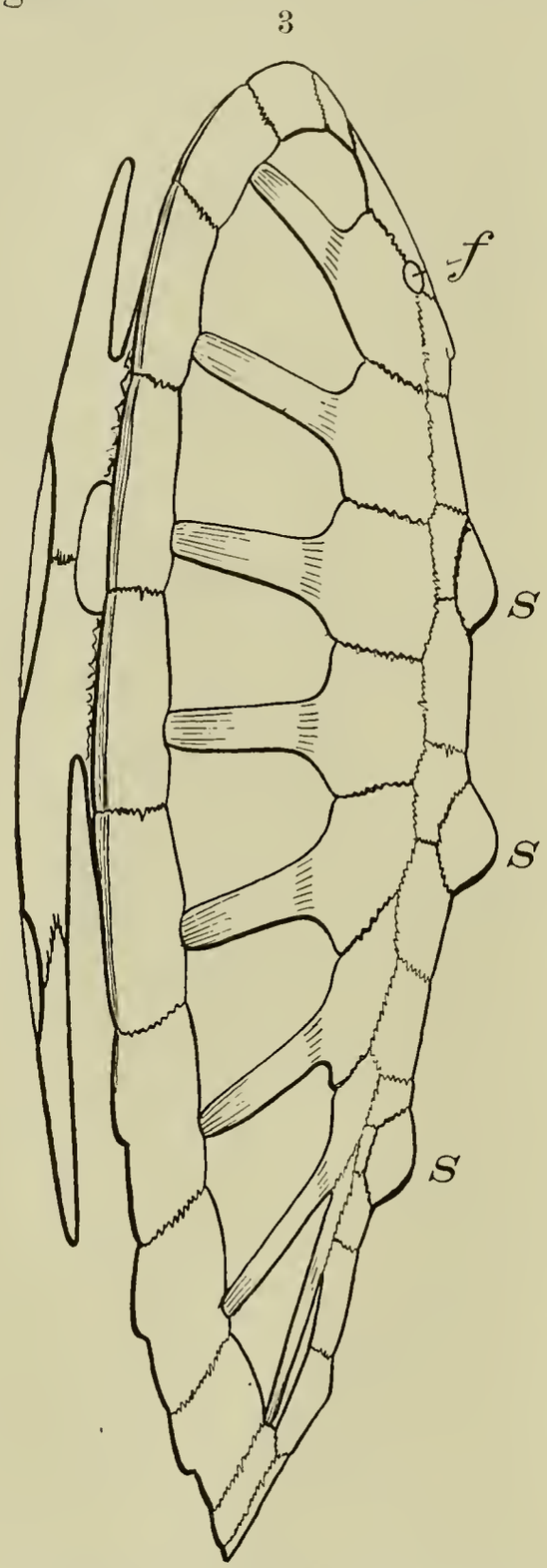

FIGURE 3.—Lateral view of the Carapace of *Toxochelys Bauri* Wieland, × ¼ nearly. Drawn from the type. *s*, *s*, *s*, the three Epi-neural spines supported respectively by the 3d and 4th, the 5th and 6th neurals, and the 8th neural and the post-neural elements; *f*, the post-nuchal foramina.

Epi-neural Spines.—The series of epi-neural spines taken in conjunction with the strongly carinate neurals, and the keeled marginals, give to the present fossil carapace a most ornate form. See figures 1 and 3.

The earliest suggestion of the possible presence of epi-neural elements in the Testudinata was made by the writer in his original description of the Fort Pierre Cretaceous turtle *Archelon* given in this Journal for Dec., 1896. It appears on page 400 of that number as follows: "One of the chief features of the carapace is the arching into a heavy dorsal ridge, beginning just back of the region of the first dorsal vertebra, and from thence continuous, except in the sacral region. It marks the position of the neural spines and is very distinctly grooved from anteriorly to the region of the eighth dorsal vertebra. Immediately over the neural spines this groove inclines to widen and send out asteriations. In life these grooves were no doubt filled with horny material, and the animal *may have borne a dorsal row of spines.*"

Two years later the spines of *Toxochelys* were first observed by Case,* and have been since more fully described and commented on by Hay, who would see in them the remnants of a former dermal series, probably once common to all turtles, and going far to explain the homol-

* Kansas Univ. Geol. Survey, vol. iv, p. 382 (1898).

ogy of the osteodermal mosaic of *Dermochelys* (6, 7). The present is, however, the first time that the entire series of ossicles and their relation to the successive neurals has been determined. As may be judged from reference to the several figures, the system of ossicles may really be a much changed and disappearing one. The first neural bears a small but very distinct completely fused boss near its middle, and then forms the beginning of the dorsal carina. The third neural which is rather short, and the fourth which is abnormally long, support a large epi-neural spine. This occupies all the median posterior three-fourths of the length of the third and the anterior fourth of the length of the fourth neurals, and is doubtless the second member of the original epi-neural series. The second free epi-neural [or third of the original series] is the largest, and is equally borne by the fifth and sixth neurals. The third free epi-neural [or fourth of the hypothetical primitive series] rests over the ninth member of the neuralia, so as to project slightly forward onto the eighth and well backward over all the anterior half of the post-neural tenth. This latter epi-neural is the smallest of the three free epi-neurals.

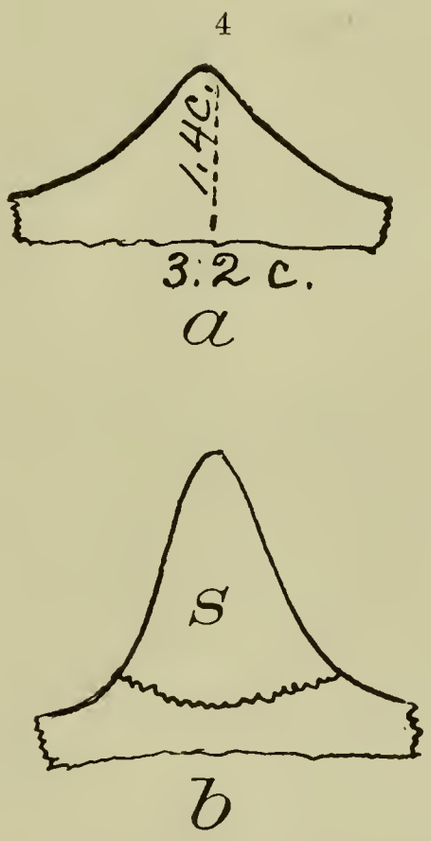

FIGURE 4.—*Toxochelys Bauri* type, $\times {}^{1}/_{1}$. *a*, Vertical transverse section through the second neural showing the average elevation and outline of the median neural carina. *b*, Vertical transverse section through anterior end of the 6th neural, and the epi-neural spine (*s*) borne on this and the 5th neurals.

Whether a fifth member of the epi-neural series was borne by the postero-pygal, which would afford the symmetrical position, is of course conjectural in the absence of this latter member of the median series.

Whether or not the keels of the marginalia mark the fusion of a lateral series of elements, corresponding to the epi-neurals, is likewise only conjectural, although it appears that some light may be shed on the subject by *Proganochelys*. There is however some uncertainty as to the number of marginals and true significance of the peculiar marginal fringe of spines in this singularly interesting turtle as so carefully studied by Fraas (4) from material recovered under conditions unfavorable to the exact preservation of structural details. But it is also a most interesting and suggestive fact that small ossicles are irregularly interpolated between the lateral marginals of the Cretaceous *Lytoloma*, as small triangular elements about $1{\cdot}5^{cm}$ on each side. Such are shown at E, E, E in the accompanying figure 5. As these epi-marginal ossicles are not equally present on both the right and left marginals even in the same individual and certainly not always present in all specimens of *Lytoloma angusta*, they would at first sight appear to be of much less significance, taken by themselves, than are the epi-neurals of *Toxochelys*. Nevertheless it would now seem that they do represent a disappearing series that may once have invested the entire margin of the carapace. If so, they form one of the most impressive examples of the very last vestiges of a vanishing series.

The truth of this hypothesis yet remains to be mainly determined by fossil evidence, which we may hope ere long to discover, if correct. At any rate it is extremely interesting and suggestive to find further traces of an additional osteodermal series in *Lyotoloma*, whatever may be the homology to that of *Dermochelys*.

What the characteristic number of elements in this system as developed in pre-Cretaceous testudinates was, no one has yet attempted to suggest. Nor is it possible to reach a safe conclusion in the absence of further paleontologic evidence. It would appear however that the series was once at least as complex as is the horn-shield and the bony plate series, and that it had some form of alternate or imbricate relationship to both these latter systems. Also, if the osteodermal mosaic of *Dermochelys* arose from such an additional dermal series, such origin must therefore have been in part by a subdivision process such as was suggested to Baur by the abnormal breaking up into smaller ossicles along the edges of the pleurals observed by him in *Eretmochelys*. Such a subdivision would of course follow the lines of the original system, and could thus very well produce the carapacial carina seen in *Dermochelys*.

It should be especially noted in this connection that such an hypothesis for the more primitive origin of the osteodermal mosaic does not necessarily imply a more ancient origin for

Dermochelys than for the Cheloniidæ, and that its correctness would not necessarily leave *Dermochelys* the most primitive of turtles, but rather the most specialized, as hitherto held by Baur, Dollo, and the writer. As stated, only new fossil evidence can settle the very interesting questions that here arise.

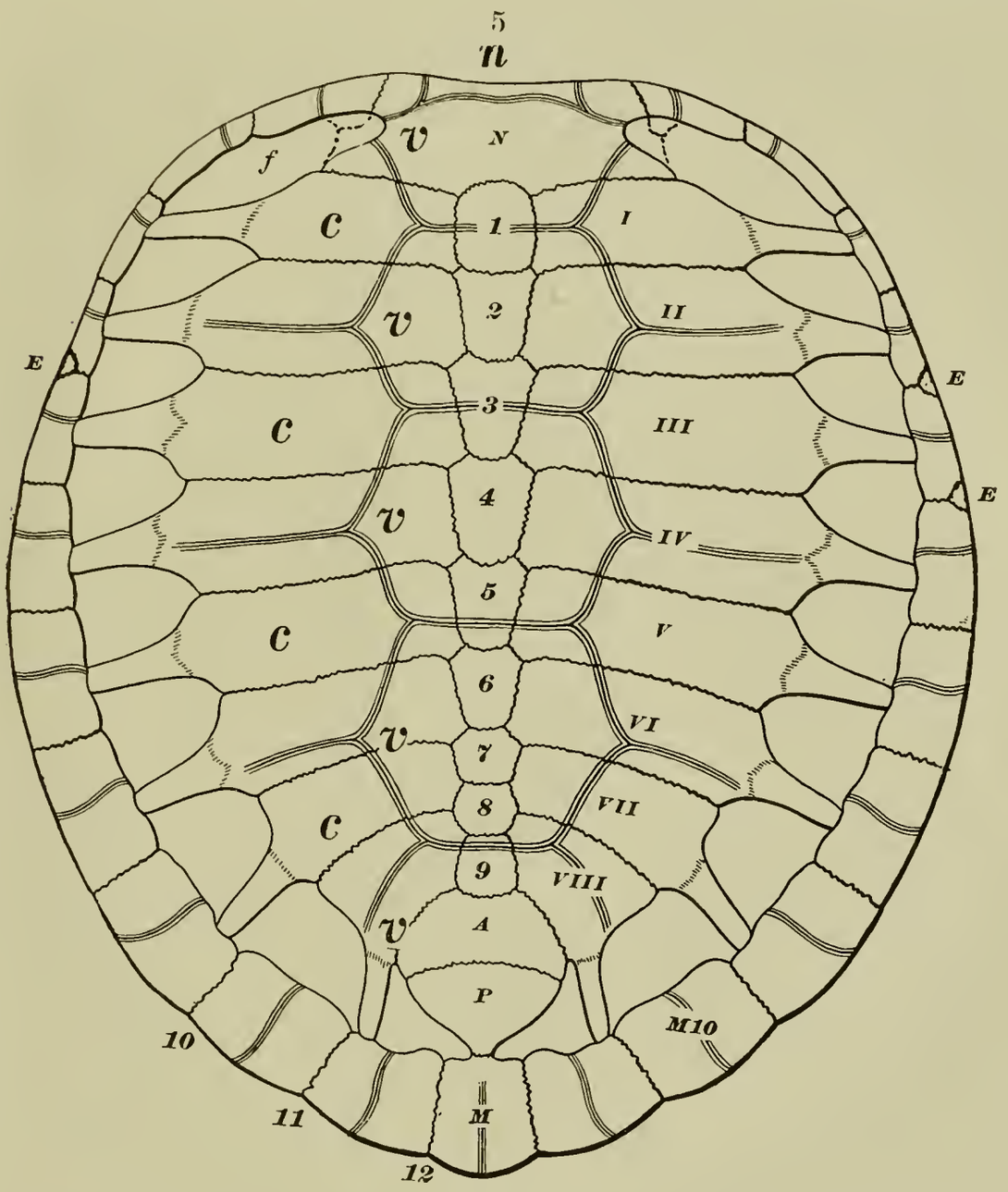

FIGURE 5.—Carapace of *Lytoloma angusta* from the Upper Cretaceous Greensand of Barnsboro, Gloucester Co., New Jersey. *E*, *E*, *E*, Epi-marginals respectively borne by the right 4th and 5th, 5th and 6th, and the left 4th and 5th marginalia. (Enough marginals are present in the original specimen—No. 625 of the Yale Collection—to determine that no further epi-marginals accompanied these three, unless such were borne anteriorly to the 4th marginals.) Epi-marginals are not always present in *L. angusta*.

The pygal region.—The neural series of *Toxochelys Bauri*, excluding of course the epi-neural ossicles, agrees with that of *Hardella thurgi* (1) in having ten elements, in the neural row, —in reality an interpolated element between the normal or

common eighth and ninth elements, or better a division of the ninth or post-neural region of the median series. Unlike *Hardella*, however, the pygal is not single, the post-neural region being divided into an antero- and postero-pygal, as in *Osteopygis*, and in the Cheloninæ. The existence and outlines of the postero-pygal are indicated by the conformation of the pleuralia and posterior marginals, together with the posterior suture of the antero-pygal and the anterior suture of the pygal marginal, which are quite unlike. From these sutural borders it is also quite evident that the heavy median keel which evenly traverses all the length of the antero-pygal, finally ran out on the postero-pygal, where it no doubt ended as a distinct boss like that of the first neural, which would perforce represent a fused fifth member of the median or epi-neural ossicular system. The pygal marginal, in correspondence with the strong keels of the marginals, is ornately double-keeled. The organization of this region has not hitherto been determined in any species of *Toxochelys*. Both Case (2) and Hay (6) have figured the posterior half of the carapace of *T.* (*serrifer*) *stenoporus* type, but without determining the sutures, whether because not indicated or because of difficulty of interpretation not being stated by either. A distinct difference from the present specimen is, however, obviously present in the postero-pygal region.

Synopsis of the Characters of Toxochelys Bauri (type).

Carapace.—Elliptical to elongate in outline with large and persistent pleuro-marginal fontanelles; composed of 52 bony plates and 3 additional epi-neural spinose ossicles; numerical arrangement of parts combining the general alignment and form seen in the Chelonine *Lytoloma angusta* with the post-neural arrangement of the existing *Hardella thurgi*. Surface finely granulate to smooth, and horn-shield sulci not apparent, save for notches formed by the posterior border of the marginal keels. (A distinctly leathery hide is not, however, supposed to be present.) Marginals, 11 pairs, rather narrow anteriorly, increasing very slowly in breadth to the 11th, which is still nearly twice as long as broad, outer borders all the way to the pygal marginal more and more sharply keeled anterior to the indistinct to absent horn-shield sulci, upper and nether surfaces of nearly equal area, supported by rib-ends only with the pits of the plastral digits small to indistinct and extending from the 3d to about the middle of the 7th; rib-pits small, with the 10th marginal ribless, and the 11th supporting the 9th rib anteriorly as in *Chelone* and *Lytoloma*.

Nuchal large and very broad, uniting by straight sutures with the 1st neural and 1st pleurals, between which are formed

posteriorly two small oval fenestrae as in the Trionychids; with a minute (incipient) nether articular projection but no costiform processes. Neuralia 8 with the post-neural bipar-

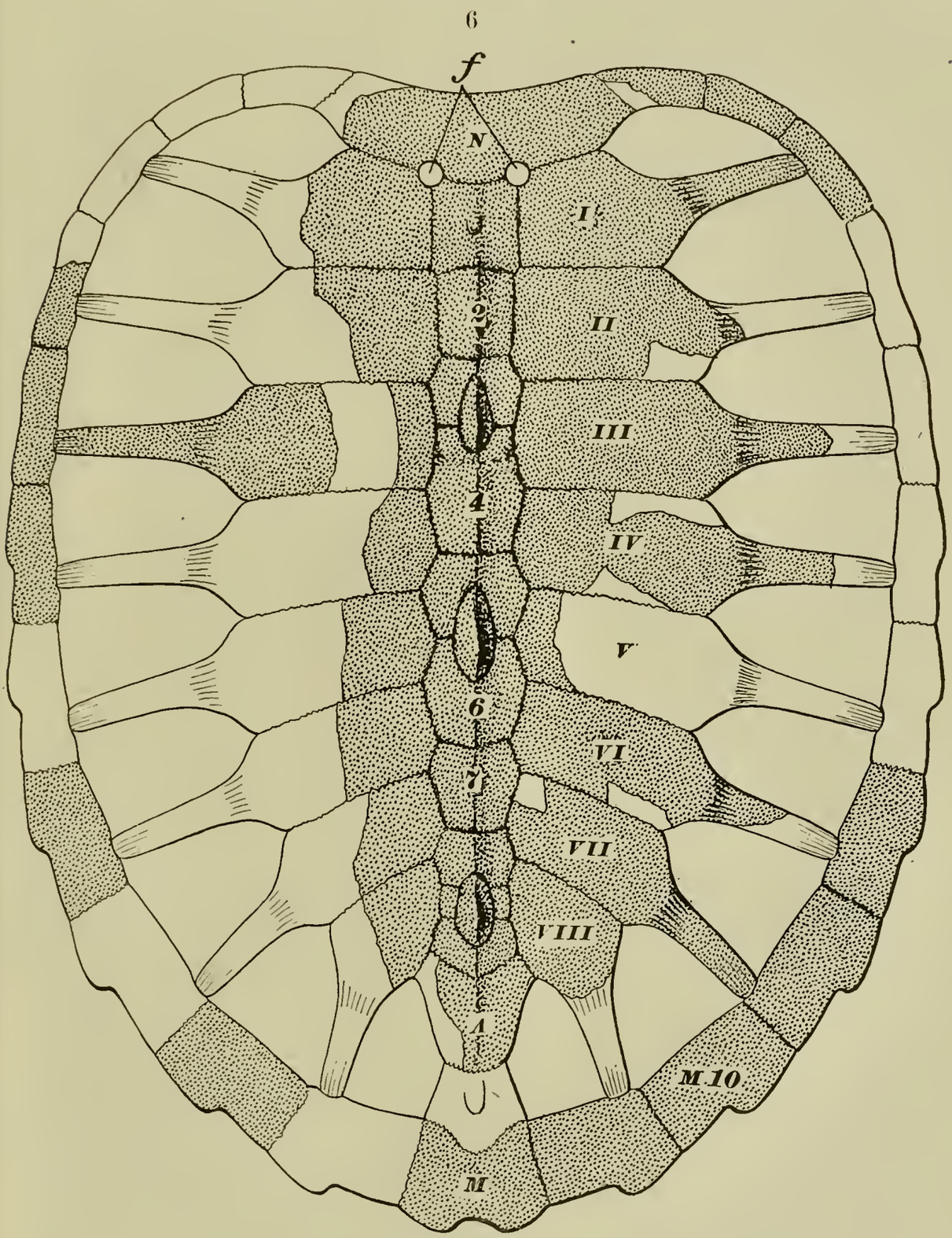

FIGURE 6.—*Toxochelys Bauri* (type). A supplementary figure to Plate X, showing by stippled surfaces the parts of the original carapace actually recovered. (Lettering as in figure 1.)

tite, oblong to hexagonal, prominently carinate and supporting the three large epi-neural spinose ossicles. Antero- and postero-pygal nearly as in *Lytoloma*. Pleuralia more reduced than in either *Chelone* or *Lytoloma*.

Plastron.—Of the same Chelydroid form seen in *Osteopygis* and *Lytoloma*.

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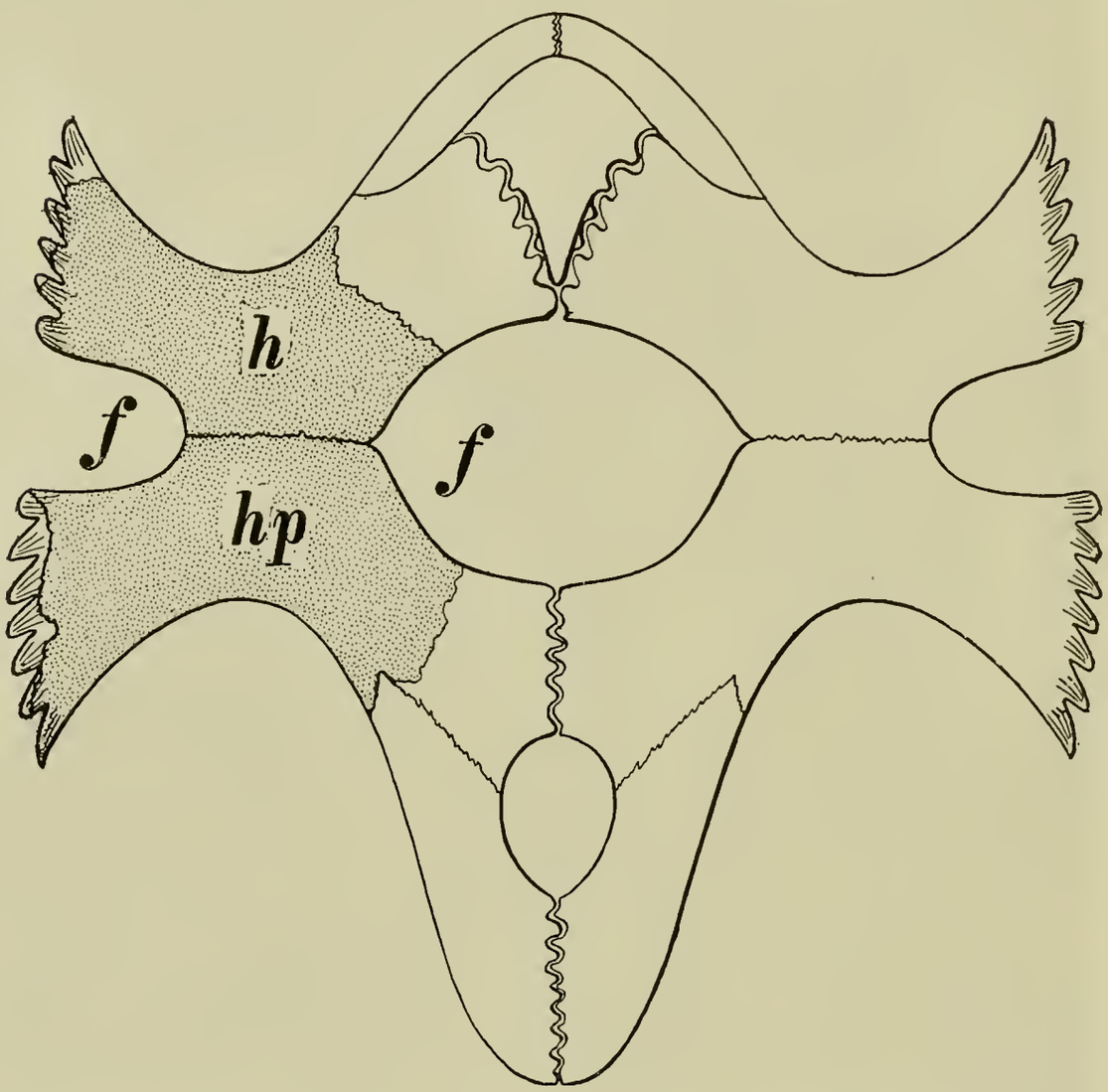

FIGURE 7.—*Toxochelys Bauri* (type). Restoration of the plastron. ×¼.—The stippled surface shows the portions of the hyoplastron (*h*) and the hypoplastron (*hp*) actually recovered.—(The epiplastron and entoplastron is only known in *T. latiremis*, cf. figure 8, and the xiphiplastron in *T. stenoporus*.)

Specific Relationships.

The specific identity of the *Toxochelys* described in the foregoing pages with any of the known species of the genus cannot be affirmed, as appears from the following analysis.—Five species have been assigned to the Niobraran genus *Toxochelys* as first established by Cope in 1873, namely: *T. latiremis*, the generic type; *T. serrifer*, Cope, 1875; *T. brachyrhinus*, Case, 1898; and *T. procax* and *T. stenoporus*, as proposed in a recent revision of the genus by Hay (8).

With *T. latiremis* as close a comparison as desirable is not yet afforded, since but few of the elements of the carapace and plastron of this form are known. It appears, however, that the nuchal was of markedly different proportions from those

of the present *T. Bauri*, as may be noted on comparison with a nuchal figured by Case.*

Nor is there specific agreement with the nuchal of the Yale specimen I referred to, *T. latiremis*, when describing the accompanying flipper (10). This nuchal is here shown in figure 8 for the sake of more convenient reference.

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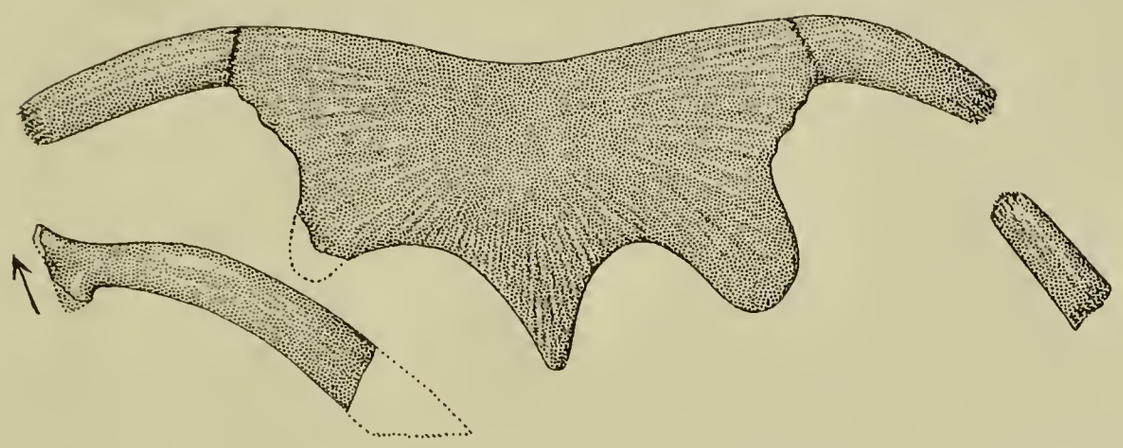

FIGURE 8.—*Toxochelys latiremis*, from the Niobrara Cretaceous, Gove County, Kansas. (Yale accession list 2419.) × about ⅓.

Nuchal with the attached first marginals of both sides and the proximal half of the right second marginal, together with the accompanying epiplastron.—This nuchal bears far back nearly in line with the front border of the large curved posterior notches a large and prominent nether process for cervical articulation.

Although true that the general form varies in turn from that just noted as figured by Case, the differences are more easily reconciled within specific limits. The simple fact is that in no previously described specimen of *Toxochelys*, and in no other semi-marine, or marine member of the Cheloniidæ, do we observe Trionychid-like foramina between the nuchal and first neural and pleurals. I may add that from recent measurements given by Hay it appears that amongst the several Toxochelyds *T. brachyrhinus* is next related to *T. latiremis;* and there is a question in my mind if the former is a distinct species, the differences in cranial proportion from *T. latiremis* being so slight as to be of very doubtful significance in specimens so invariably crushed at more or less varying angles as are the Niobrara fossils.

With the skull fragments and crushed [9th] left marginal of *T. serrifer* as recently figured for the first time by Hay (8), I am unable to identify the present handsome specimen. As the horn-shields of *T. serrifer* formed a very deep marginal notch leading into a pronounced sulcus (as indicated by Hay), there appear to be distinct differences. It is, of course, one of the difficulties of vertebrate paleontologists that species based

* University Geol. Survey of Kansas, pl. lxxxii, figure 3.

on such meager skeletal parts accumulate in the course of time; but surely we are permitted little diffidence in applying the laws of priority and nomenclature now in vogue to a handsome and reasonably complete fossil like that discussed in the present paper. Perhaps the day is not distant when fragments will be merely noted within generic limits, and then numbered and laid aside for a certain number of years before being arbitrarily dignified as the types of new forms. Assuredly such a method would simplify the study of extinct faunæ. The extreme difficulty of reaching accurate specific identifications after most painstaking comparisons and study of descriptions primarily based on fragmentary material, has been especially brought home to the writer in his consideration of the Upper Cretaceous Turtles of New Jersey, and he has great sympathy with Professor Marsh's oft repeated contention that the types of extinct vertebrates ought to be mainly founded on fairly complete forms.

With the isolated and imperfect skull of rather large and robust form named *T. procax* by Hay, as with that of *T. brachyrhinus*, no comparisons are afforded by the material thus far obtained.

From *T. (serrifer) stenoporus*, finally, *T. Bauri* differs distinctly. as shown by comparison with the posterior half of the carapace figured by Case.* From that and other specimens of *T. (serrifer) stenoporus* the present fossil differs in being of a larger type with relatively heavier marginals and larger pleural plates; also in the much more pronounced sutural union of the postero- and marginalo-pygal, which is reduced to peg-like junction in *T.* (*serrifer*) *stenoporus*.

Systematic Position of the Genus Toxochelys.

Because of the carapacial organization with much reduced pleurals and marginals, as well as certain plastral characters, all suggesting primitive relationships to the Cheloniidæ, it was first suggested by the writer on his discovery of the organization of the front leg of *Toxochelys latiremis*, that the Toxochelyds do not justly constitute a separate family of turtles, as proposed by Cope and held by Hay, but are better classified as a sub-family of the Cheloniidæ, the Toxochelydinæ. Recently Hay, while accepting the principle that the limbs do furnish "a test of the correctness of this disposition of the genus," interprets the evidence differently (7). He now reaches the conclusion that Wieland misinterpreted the limbs of *T. latiremus* (10), and that these, as in the Trionychid *Amyda spinifera*, were merely long fingered and webbed,

* Kansas Univ. Geol. Sur., vol. iv, plate lxxxiii.

and not markedly modified for marine life, so that *Toxochelys* "did not navigate the open seas."

In support of his contentions Dr. Hay uses a percentual method of comparison in which the humerus is conveniently and arbitrarily considered the unit in terms of which the length of the digits is expressed. This very effective means of comparison was first used by the writer in the case of forms in other ways related, and is, within limits, unquestionably useful in a diagrammatic sense. But Dr. Hay now mistakenly employs it in a far wider application than originally contemplated, when he reaches direct conclusions as to the front limb of *Toxochelys* by comparison with the Trionychid *Amyda spinifera*, thus:—

	Arm.			Fingers.				
	Humerus.	Radius.	Ulna.	1st.	2d.	3d.	4th.	5th.
Amyda	100	53	51	69	90	98	116	98
Toxochelys	100	58	50	51	73	100±	104±	70±

One might as well go on to prove that the "hawks-bill," *Eretmochelys imbricata*, is unable to "navigate the open seas". —For similarly:

	Arm.			Fingers.				
	Humerus.	Radius.	Ulna.	1st.	2d.	3d.	4th.	5th.
Amyda	100	53	51	69	90	98	116	98
Eretmochelys	100	53	44	49	89	128	105	44

Whence the following differences:

	Arm.			Fingers.				
	Humerus.	Radius.	Ulna.	1st.	2d.	3d.	4th.	5th.
Amyda	--	--	+7	+20	+1	--	+11	+54
Eretmochelys	--	--	--	--	--	+30	--	--

It is clear that save for that short thumb and long fourth finger of *Eretmochelys*, were this an extinct form, no conclusive evidence of the true flipper development would be afforded by such measurements as the above when considered alone. For it is a noteworthy fact that the disparity between the thumb and fourth finger of *Amyda* is +47 as against +53 in *Toxochelys*, and +56 in *Eretmochelys*. Yet as a true indication of unequal finger development, instead of disparity between only the short first and the long third and fourth fingers, as in *Eretmochelys*, there was in *Toxochelys* strong disparity between the short first and second and the long third *and fourth* fingers. There was also ulnar disparity.

All these fundamental numerical relations have been overlooked in Dr. Hay's criticism. He entirely ignores, too, the

fact that as a merely web-footed turtle *Toxochelys* would have been very unlike *Amyda*. For these percentual results must always be considered in connection with the humeral changes in the direction of marine forms, which are indicated in the thalassoid humerus of *Toxochelys*, as well as the enlargement of the pisiform to nearly the same size as in *Eretmochelys*. In short, it is evident that Dr. Hay overlooked important factors and that his views are untenable.

When I originally described the flipper of *Toxochelys* I was of the opinion that it represented the most primitive form yet discovered that could be called more distinctly marine than merely natatorial, long-fingered and web-footed; and now that I have had the present opportunity to briefly reconsider the subject I may say that I believe this interpretation in accord with the facts.*

Dr. Hay "readily grants that the fore limb of *Toxochelys* had entered on the early stages of those modifications which resulted in the production of flippers." But as clearly enough indicated by the facts, much more modification had been undergone, and the foot was more a swimming than a walking one. Whether the third to fifth fingers were encased in a leathery hide, or still retained some of their freedom of motion, as in distinctly webbed types, is open to some question; but nevertheless finger disparity, reduction of the 3d–5th claws, pisiform enlargement and humeral change had all been accomplished to such an advanced extent that the limb is to be regarded as a flipper, quite admirably fitting *Toxochelys latiremis* to range the great inland Niobrara Sea. And even were the anatomical facts of less certain interpretation, the *onus probandi* would rest on him who asserted the non-marine nature of those turtles which occur so widely distributed in as extensive a chalk formation of indisputably marine origin as the Niobrara Cretaceous.

It is very evident, therefore, that on the basis of limb organization *Toxochelys* is a member of the Cheloniidæ, and that as proposed by the writer on the basis of the general organization, limb structure, and relationships the genus is most conveniently placed in the Chelonidan sub-family Toxochelydinæ.

As a concluding word it may be added for the sake of clearness that no great diagnostic significance is attached to the presence of the epi-neural ossicles,—certainly not if they are to be regarded as vestiges of a disappearing system, likewise indicated in the genus *Lytoloma* of the Cheloninæ.

Yale Museum, New Haven, Conn., Sept. 26, 1905.

* In view of the great interest of the subject I will as early as convenient refigure the flipper of *Toxochelys* with all possible care. Dr. Hay is also of the opinion that the great turtles of the Fort Pierre, and perforce the Niobrara *Protostega* were likewise littoral and web-footed rather than marine. As will be incontestably demonstrated by the writer in a forthcoming Memoir of the Carnegie Museum of Pittsburgh, *Protostega* and *Archelon* were powerfully equipped for their marine habitat.

Measurements of Carapace and Plastron of Toxochelys Bauri.

(Yale Museum accession list 2823. Elements disarticulated and more or less altered in form by crushing in matrix. Recovered portions as shown in the accompanying figure 6 by the stippled surfaces.)

Length of carapace (estimated to within 1 or 2^{cm} ..... 53^{cm}
Breadth of carapace (greatest, as measured across the anterior end of the 6th neural) ..... 40+

	(*a*) Exact length on outer edge of carapace.	(*b*) Width measured at notch of the hornshield sulci.
Nuchal	12·0	--
1st marginal	6·0	2·5
2d "	5·0	2·5
3d "	5·9	2·8
4th "	6·0	-
5th "	6·5	2·8
6th "	7·0	3·3
7th "	7·5	--
8th "	8·0	4·5
9th "	7·5	4·5
10th "	7·0	4·5
11th "	6·8	4·5
Pygal	7·0	4·5

(The thickness and transverse sections of the marginals are approximately the same as in *Lytoloma angusta*. Owing to the crushing undergone by most of the marginals a closer approximation cannot readily be given.)

	Length on Median line.	Greatest width.
Nuchal	5·5	14·5
1st neural	3·8	3·8
2d "	4·4	3·7
3d "	4·4	4·0
4th "	4 6	4·4
5th "	3·4	4·5
6th "	5·0	4·0
7th "	4·0	3·8
8th "	2·5	3·5
9th "	1·5	3·5
(10th)"	2·5	3·4
Antero-pygal	4·5	5·9
(Postero-pygal)	(3·5)	(4·0)
Marginalo-pygal	4·5	6·5

1st epi-neural ossicle	3·5	1·7
2d " "	4·5	2·0
3d " "	3·9	1·5

(Thickness of 2d neural measured through carina, 1·4^{cm}.)

(The total height of the epi-neural ossicles is respectively, 15, 21, and 15^{mm}, the projection above the carina, 9, 12, and 9^{mm}.)

	(*a*) Length over curvature.	(*b*) Length of posterior sutural border.	(*c*) Median width.
Nuchal	---	[10]	--
1st pleural	15·0	6·5	5·7
2d "	18·5	8·4	5·5
3d "	19·5	8·4	5·0
4th "	19·5	8·2	4 9
5th "	19·0	7·7	4·8
6th "	17·5	6·9	4·5
7th "	14·5	5·1	3·8
8th "	11·5	2·2	3·8

(The average thickness of the pleurals is 50^{mm}. The distance between the bases of the rib-capitulae of the 7th pleurals is 4^{cm}. The large pleuro-marginal fontanelles are approximately one-half, or more than one-half the length of the pleurals which bound them. The hornshield sulci, save for the notched marginals, are indistinct.)

The Plastron. (Cf. figure 7.)

Length on median line	39 ± ^{cm}
Greatest width	36 ±

(With added width of the inferior faces of the adjoining marginals, or 2^{cm} × 2, this measurement yields as the approximate breadth of the carapace 40^{cm}.)

Width (on antero-posterior line) of the marginalo-hyo-hypoplastral fontanelle	5·0
Length of hyo-hypoplastral suture	6·3
Least width of the hyo-hypoplastral bridge	11·0

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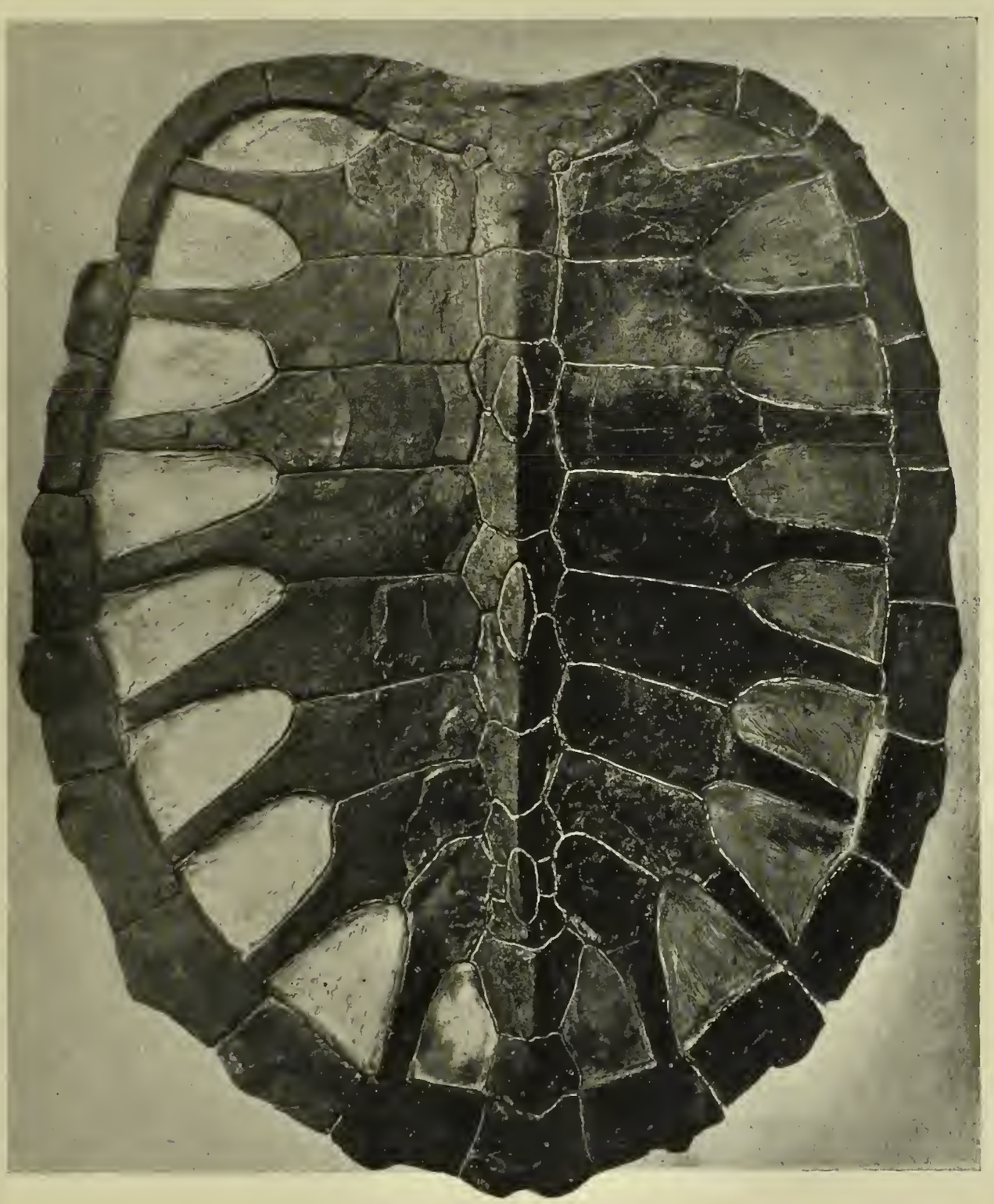

Carapace of *Toxochelys Bauri* Wieland sp. nov. from the Niobrara Cretaceous of Gove County, Kansas, as partly restored and mounted in the Yale Museum.—Actual length about 53^{cm}.